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Spectral/hp element modeling of floating bodies in a Boussinesq framework

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The wave energy sector relies heavily on the use of linear hydrodynamic models for the assessment of motions, loads and power production. The linear codes are computationally efficient and produce good results if applied within their application window. However, recent studies using two-phase VOF-RANS simulations of point-absorbers close to resonance have indicated that there might be significant differences between the power production using linear hydrodynamics and VOF-RANS. At present VOF-RANS simulations are too computational expensive to be used in the design cycle. In shallow and intermediate waters a possible middle way between the highly simplified and fast linear hydrodynamics and the very complete but slow VOF-RANS simulations is to use nonlinear, dispersive wave equations of Boussinesq-type. Jiang (2001) presented a unified approach for including bodies into the Boussinesq framework and solved the system with finite differences. In the unified approach the pressure working on the body are solved for using the instantaneous draft. In this study we will outline how to implement the approach of Jiang in a spectral/hp element setting, and simulate the heave motion of a body using different asymptotic wave equations. We will especially focus on the stabilization of the coupled system.